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OLDMAN RESERVOIR MULE DEER

Report On Fawn Studies,

1992 to 1995

Prepared for

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EXECUTIVE SUMMARY

This report contains the results of four consecutive years of study during the fawning season, 1992 to 1995. Movements, habitat use and productivity of radio-collared adult female mule deer were observed. The intensity of field work varied year to year as did the number of radio-collared females available for individual study.

Percent annual mortality on a cohort of 17 adult females radio-collared in February-March 1992 was estimated to be about 12% through 1995. Higher adult female mortality appeared on a cohort of 7 radio-collared adult females radio-collared during January-February 1994. Causes of mortality have not been part of this investigation, although coyotes have been identified as the only major predator in the study area. Other causes of mortality may include accidents and road kills.

Field study of individual radio-collared adult females during parturition revealed that:

- most fawns at the Oldman Reservoir are born about mid-June, although the mean birth date varied among years by as much as a week;
- a degree of annual fidelity to fawning areas was apparent, although fidelity was not "patch" specific. Birth sites were on average about 0.90 km apart among years (range, 0.10 to 2.66);
- while fawns were born in a wide variety of habitat types, most birth sites were associated with upland grasslands, coulee shrublands or riparian cottonwood stands;
- upper river reaches of the Reservoir are the only areas that support these important habitat types, and for landscape management purposes these areas could be considered "fawn factories;"
- productivity of the herd varied year to year; the highest productivity was observed during the last two years of study at about 1.36 fawns/ female/ year;
- the twinning rate varied year to year but it appeared to be highest during the last two years of study at about 43%.

These reproductive values describe a productive, if not highly productive, mule deer population. The various pieces of information available suggest that the mule deer population at the Oldman Reservoir has been expanding as generally indicated by results of recent winter aerial surveys.

ACKNOWLEDGMENTS

A number of individuals have been responsible for collecting information over the course of the past four years. During 1992, 1993 and 1995, field studies were conducted by Axys Environmental Consulting Ltd. under contract to Alberta Environmental Protection. During 1994, the work was conducted by Alberta Environmental Protection's project biologist, John M. Mahoney and his staff which included specifically M. Pichlyk, R. Plante and J. Potts.

Staff of Axys Environmental Consulting Ltd. that have worked on the project during 1992 and 1993 included Mr. Peter Balagus and Mr. Rick Lauzon. Mr. Darren Balaney, hired on term employment for the 1995 season, conducted the field work with a high degree of dedication, proficiency and independence.

I would also like to acknowledge the staff at the Oldman Dam Control Building for loan of the radio-telemetry equipment that we used to relocate the mule deer.

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1.0 INTRODUCTION

The Oldman River Dam was constructed in order to regulate downstream flows by storing water in an onstream reservoir and thereby ensuring a dependable water supply for Albertans living downstream of the Dam (Oldman River Dam Fact Sheet). The Reservoir was initially filled during spring 1991, although the dam was not completely operational until 1992.

Mitigation programs have been established around the periphery of the Reservoir in order to lessen the impact of dam construction and operation on the environment. Four mitigation components were identified: fisheries, wildlife, historical resources, and recreation. Each component has been conducted in four general phases:

- Overview and Data Collection;
- Assessment and Mitigation Design;
- Mitigation Implementation;
- Monitoring.

This report is one of a series of wildlife reports that have been produced in the monitoring phase. This report provides the results of behavioral studies of radio-collared adult female mule deer during four consecutive fawning season, 1992 to 1995. This follows the initiation of a long-term monitoring program of mule deer population dynamics using radio telemetry during winter 1991-92 (Hornbeck and Balagus 1992a). This monitoring program was initiated after construction of the Reservoir, in an attempt to assess the effects of the operation of the Oldman Dam and Reservoir on various aspects of the mule deer's ecology and life history.

1.1 BACKGROUND

Mule deer (*Odocoileus hemionus*) are one of the most highly visible and economically important wildlife in the Oldman Reservoir basin. Recent aerial surveys have indicated that the Reservoir basin supports about 900 mule deer (Hornbeck and Balagus 1994). Based on a series of winter aerial surveys of the mule deer population that extend back to 1985, an increasing population trend has been identified.

Prior to reservoir construction, various predictions had been made regarding the effects of the altered landscape on the local mule deer population. These predictions ranged from severe population decline to changes in movement and habitat utilization patterns, particularly during winter when lack of riparian forest and shrubland in the reservoir basin may cause deer to move to adjacent farmland for food and shelter. The potential for an increased number of road kills resulting from the development of a paved grid road surrounding the Reservoir was also identified.

This report contains the results of field studies conducted during four consecutive fawning seasons at the Oldman Reservoir. Results of previous years' fawn studies contained in progress reports (Hornbeck and Balagus 1992b; Hornbeck, Balagus and Lauzon 1993; Project Biologist John Mahoney 1994, pers. comm.) have been brought

forward and are presented along with the current 1995 results in order to provide an integrated analysis of the four years of study.

1.2 SCOPE AND OBJECTIVES

The objectives for closely monitoring parturient females was to identify productivity, fawning habitat and annual site fidelity. Answers to the following questions were sought:

- What is the chronology of the mule deer fawning season?
- What is the productivity of the mule deer herd?
- What are the local movement and habitat use patterns of parturient females, and can "fawning areas" be identified?

2.0 STUDY AREA

2.1 LOCATION AND LAND USE

The Oldman Reservoir basin is approximately 12 km north of the town of Pincher Creek (Figure 1). The area is located in the fescue grassland ecoregion of southwestern Alberta, adjacent to the eastern edge of the Rocky Mountain foothills (Strong and Leggat 1992). Because reservoir development has inundated the deep coulees and river breaks along portions of three river systems, only remnant forest stands occur in the study area. The landscape surrounding the reservoir is gently undulating, dominated by mixed-farming practices. Hay crops, barley and wheat are the principle grains, and beef cattle are the dominant livestock (Alberta Agriculture 1991).

Native grasses within non-cultivated areas and coulee ridges immediately surrounding the reservoir include rough fescue (*Festuca scabrella*), western wheatgrass (*Agropyron smithii*), parry oat grass (*Danthonia parryi*) and june grass (*Koeleria gracilis*). Shrub communities within the remaining river breaks and coulees are comprised primarily of saskatoon (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), wolf willow (*Elaeagnus commutata*), skunkbrush (*Rhus trilobata*) and creeping juniper (*Juniperus horizontalis*). Prior to clearing the river valley to the reservoir's full supply level, the river bottom was dominated by cottonwood (*Populus spp.*), aspen (*Populus tremuloides*), and Douglas fir (*Pseudotsuga menziesii*) on the steeper, north-facing slopes of the river valleys. Only remnant stands of these forest communities now remain above the full supply line. A detailed description of the vegetation in the study area prior to flooding of the reservoir is provided by Reid *et al.* (1985).

For this study, 8 different habitat types have been identified in the project area based on vegetation and associated biophysical features:

1. Upland Grassland.
   Native prairie grasslands surrounding the Reservoir topographically above the coulee formations of the river breaks. Upland grasslands are dominated by wheat grass (*Agropyron smithii*) - june grass with some rough fescue and oat grass.

2. Coulee Grassland.
   Native grasslands associated with coulee formations. These grasslands occur mostly on windward slopes of coulee formations which have dry aspects. Generally, rough fescue (*Festuca scabrella*) is the dominant grass.

3. Upland Shrub.
   Upland shrub communities of chokecherry and saskatoon that occur on gentle slopes associated with the agricultural landscape above the coulee formations of the river breaks.

4. Coulee Shrubland.
   Shrub communities of chokecherry and saskatoon occur within most of the coulee formations associated with river breaks that lead into the Reservoir. These shrublands occupy the lee slopes of coulee formations where moisture and soil conditions are most favorable.

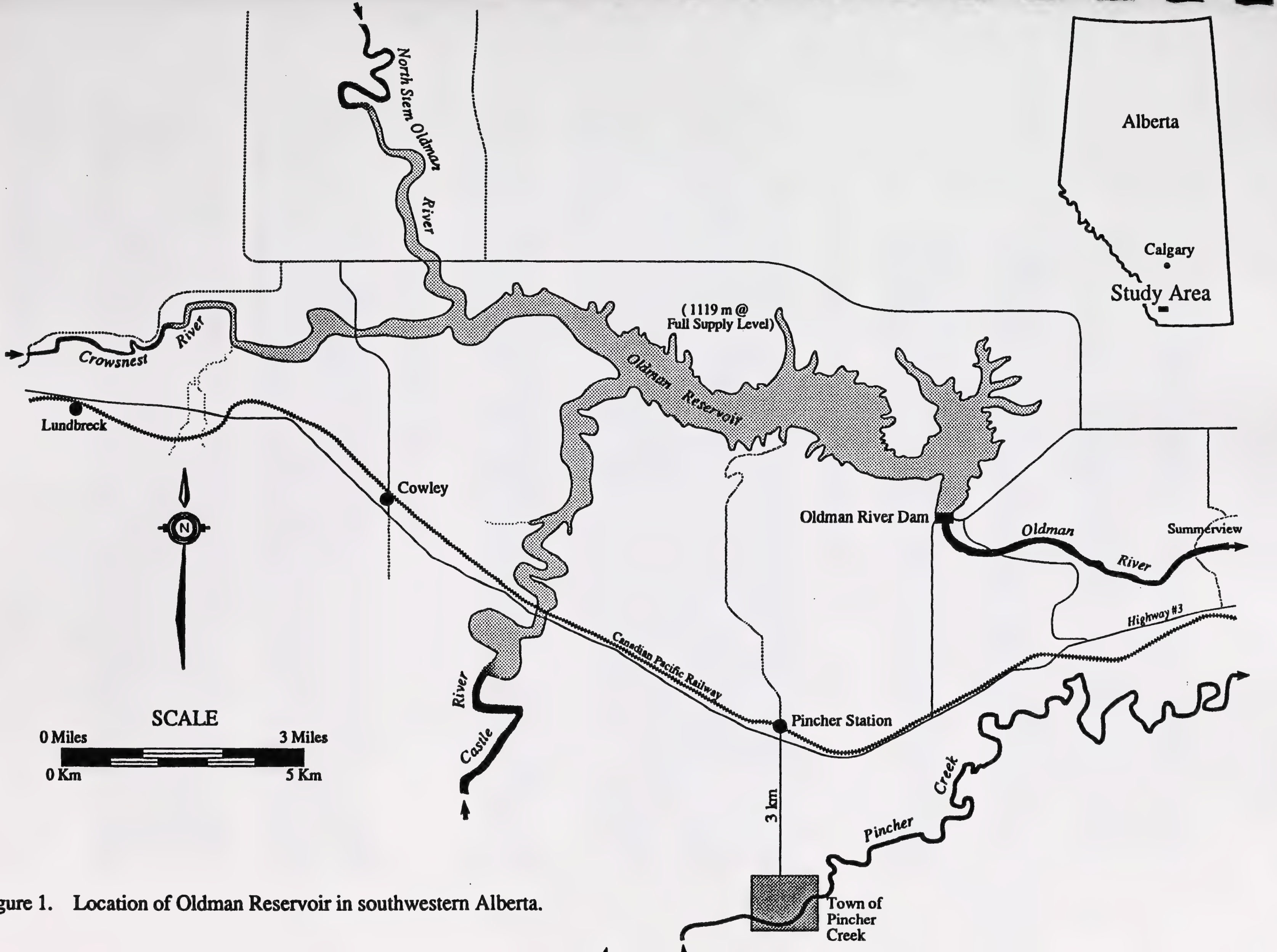

Figure 1. Location of Oldman Reservoir in southwestern Alberta.

5. Cultivated Field.
Fields surrounding the Reservoir are cultivated for cereal grain and alfalfa.

6. Aspen.
This habitat type is comprised of aspen clones associated with river banks, generally in upper reaches of the Reservoir.

7. Douglas Fir.
Douglas fir stands remain on steep slopes in a number of areas surrounding the Reservoir and extending down to the full supply line.

8. Cottonwood.
Stands of riverine poplar (*Populus* spp.) in areas of the reservoir above the full supply level and within some of the deeper coulee formations where ground water is at or near the surface.

2.2 DESCRIPTION OF THE RESERVOIR

Three river systems comprise the watershed and basin of the Oldman Reservoir: the Oldman River, the Crowsnest River and the Castle River (see Figure 1). The North Fork of the Oldman River drains the lower slopes of the Porcupine Hills. The Castle River drains the Carbondale Hills along the eastern slopes of the Rocky Mountains, while the Crowsnest River drains the southern slopes of the Livingstone Range. The reservoir basin occupies 15.4 km of the original Main Stem of the Oldman River. Approximately 12 km of the Castle River and 7.5 km of the Crowsnest River have been incorporated into the reservoir. The reservoir also extends about 5.4 km into the North Stem of the Oldman River. The volume of the reservoir at full supply level is 490,000 dcm^3 with a surface area of approximately 1,842 ha (1,118.6 m asl). The shoreline at full supply level has a perimeter of about 104 km.

The Oldman Reservoir was initially filled during spring 1991, overflowing the spillway on 4 June. The reservoir was allowed to empty during summer-fall 1991 and did not refill until mid-summer 1992. The reservoir level was near full supply level (1114 m asl) during the current survey.

2.3 OTHER WILDLIFE IN STUDY AREA

White-tailed deer (*Odocoileus virginianus*) occur in the project area, but their numbers are far exceeded by mule deer. In particular white-tailed deer are rarely seen around the Main stem of the Reservoir, but have been seen in large groups downstream of the Reservoir, and in the upper areas of the Oldman North Stem, the Castle River and Crowsnest River. White-tailed deer do not appear to have an affinity for the river breaks and rugged coulee formations where the mule deer predominate.

Coyotes (*Canis latrans*) are common in the Oldman Reservoir basin and are likely the only important predator of mule deer, particularly neonates as has been observed in other mule deer ranges (case studies reviewed by Connolly 1981). Red fox (*Vulpes vulpes*) have also been seen in the study area. Seventeen coyotes were observed during the most recent winter aerial census conducted during 28 February and 1 March 1994 (Hornbeck and Balagus 1994). However, no other information has been gained regarding the number of coyotes in the project area, or their impact on the mule deer.

During the current fawn study, which was the most intensive compared to previous efforts, only 2 observations of coyotes and one observation of a red fox was reported in the study area. One observation sequence however is noteworthy. On 6 June 1993, deer #28 was observed with her fawn at 0745. Within 10 minutes, the fawn laid down and #28 walked away and out of sight. At 0940 a coyote was observed coursing along the contour of the river breaks, crossing the immediate area where #28's fawn was bedded. The coyote was again observed at 0955 crossing #28's fawning area in the opposite direction; the coyote was scenting the wind and gave the impression of actively searching. On close approach to the fawning area at 1030 hr, the biologist flushed the coyote. While searching the immediate area for evidence of predation, #28 also flushed from a nearby saskatoon shrub thicket. Although the coyote was actively searching the fawning area, no evidence of predation was found.

Based on the general lack of coyote observations during intensive field work conducted on parturient females, the impression is that coyotes have not been a major source of neonatal mortality.

3.0 METHODS

Radio-collared adult female mule deer (> 19 months old) were relocated on a semi-regular basis during the fawning season by close approach from the ground. Recognizing that mule deer are "classic hiders" (Geist 1981), and that females only visit neonates occasionally for brief periods for nursing, the close approach was necessary. White *et al.* (1972) observed in white-tailed deer that when not attending fawns they were often observed feeding or resting from 50 yards to a mile away in the company of other deer. Our experience is that the same is true for mule deer. Every effort was made during each close approach to remain transparent to the radio-collared deer so as not to influence movements or selection of habitat. Relocations were recorded to the nearest 100 m with UTM grid references interpreted from 1:50,000 scale topographic maps. Visual contact with each deer was attempted during each relocation in order to determine the location and date of fawn birth, and number of fawns born to each female.

For each fawn located, the habitat type was recorded (Appendix Table 1). For all observations of fawns, notes were kept regarding their agility, and their birthdates were estimated by backdating on the basis of this information. Generally, when radio-collared deer were in the open (grasslands or low shrub habitat), deer were observed continuously with a spotting scope from several hundred meters for an extended period (≥ 2 hours) in order to determine by visual confirmation or by behavioral clues if fawns were present. When deer were concealed in tall shrub or forest, the biologist maneuvered for a visual confirmation of a fawn. When a deer was startled unexpectedly, a search was conducted within the immediate area for the possibility that a fawn had been recently born and was concealed.

To investigate birth site fidelity, the distance between newborn fawns between years was calculated as the straight line distance using geometric relationships and "corrected" easting grid references (Appendix Table 2). Because the study area spans two NTS map sheets (82 G/9 and 82 H/12), a common reference frame was developed by projecting the UTM grid from 82 G/9 onto and across 82 H/12. Therefore, the "corrected" easting applies to all relocations on the 82 H/12 map sheet whereby the value of 66.0 is subtracted from each 82 H/12 grid reference.

The number of radio-collared adult females in the project area varied from year to year (Table 1) as additional deer were trapped and radio-collared, and as mortality occurred among collared deer. During the first two reproductive seasons of 1992 and 1993, 16 female mule deer were available for individual study. Two additional deer were radio-collared during winter 1992-93, and several more female mule deer were radio-collared during January and February 1994. During 1994, 22 adult female deer were available for individual study. Fourteen (14) radio-collared adult female mule deer were in the project area during the 1995 fawning season.

Table 1. List of radio-collared female mule deer in the Oldman Reservoir project area that provided relocations during four consecutive fawning seasons, 1992 to 1995.

Deer - Radio Collar Freq.	Radio-collared Deer Relocated During Fawning Season 1992	1993	1994	1995
Radio collared during February and March 1992				
6 - 148.731	6	6	6	6
7 - 149.921	7	7	7	*off-the-air*
8 - 149.951	8	8	8	8
13 - 150.095	13	13	13	*off-the-air*
16 - 150.116	16	16	16	16
22 - 150.014	22	22	22	*off-the-air*
25 - 150.045	25	25	25	25
26 - 150.055	26	26	26	26
28 - 148.566	28	28	*off-the-air*	
29 - 150.064	29	29	29	*off-the-air*
35 - 150.073	35	35	35	35
38 - 150.083	38	38	38	38
39 - 150.263	*not relocated*	*not relocated*	39	39
42 - 150.104	42	42	42	*off-the-air*
45 - 150.124	45	*not relocated*	*off-the-air*	
46 - 150.156	46	46	*off-the-air*	
47 - 150.164	47	47	47	47
Radio collared during January 1993				
Y4 - 150.184		*not relocated*	*not relocated*	Y4
Y8 - 150.036		Y8	Y8	Y8
Radio collared during January and February 1994				
51 - 150.206			51	51
54 - 150.555			54	*off-the-air*
55 - 150.303			55	*off-the-air*
57 - 150.023			57	*off-the-air*
59 - 150.295			59	59
60 - 150.314			60	*off-the-air*
62 - 150.194			62	62
Total No. of Deer	16	16	22	14

4.0 RESULTS AND DISCUSSION

An overview of the research program is presented prior to the presentation of results regarding individual objectives. The efficiency at locating newborn fawns (identifying the time and location of birth, as well as identification of habitat type) is discussed. An understanding of this efficiency is fundamental for evaluating the success of the research program, and for designing similar work in the future.

4.1 OVERVIEW OF RESEARCH PROGRAM

Axys Environmental Consulting Ltd. was responsible for relocating radio-collared female mule deer during three of the four seasons of study: 1992, 1993 and 1995. During the first season of study (1992) a total of 91 hours were spent observing deer at close range during fawning (Table 2). The last relocations in the field during 1992 were obtained on 12 June before all the fawns had dropped. In hindsight, the span of parturition among mule deer was underestimated, but budgets did not allow an extension. During 1993, field work was intensified and the amount of time spent observing deer at close range during the fawning season was doubled from the previous year to 189 field hours (Table 2). Field work during 1993 was also extended to 18 June. During 1994, the project biologist at the Oldman Dam arranged for the field work. Field monitoring during the 1994 fawning season was conducted with relatively low intensity with approximately 58 hours spent in the field during June (see Table 2). The 1995 field season was the most intensive of the 4-year study, with some 303 hours spent in the field from 31 May to 30 June, inclusive (see Table 2).

Overall, only eight (8) radio-collared deer have been available for continuous observation over the course of four years of study: deer #6, 8, 16, 25, 26, 35, 38 and 47 (see Table 1). Unfortunately, within this group of eight deer, information on annual fawn production is not complete. The information is incomplete because the intensity of relocation effort, as discussed above, varied among years (see Table 2).

Efficiency at Locating Fawns

Success at locating newborn fawns from radioed females, and fawns unrelated to radioed females (see Table 2), varied among years (Table 3). A relatively low level of success at locating newborn fawns from radioed females was achieved during 1992 (ratio of deer confirmed with fawns/ available radio-collared deer = 25%). This low success occurred because the length of the birth season was under-estimated and the budget that was submitted for field work did not allow for an extension when work ended before all the deer had dropped fawns. Success was also relatively low during 1994 (50%), largely because of relatively low field search intensity (i.e., consecutive relocations of individual deer were sparse and widely spaced). With widely spaced relocations (Appendix Table 2) results are inconclusive as to whether a fawn(s) was born to a particular female (see Appendix Table 1).

Success at locating fawns born to radio-collared females was positively related to the number of field hours expended (the intensity of search effort = no. of times females were relocated within a season). Complete success at confirming whether each radio-collared female did or did not have a fawn was achieved during the 1995 fawning season with an expenditure of some 303 field hours spread throughout the entire month of June.

The intensity of relocation efforts (total no. of relocations per season/ no. of radioed deer) during each fawning season was: 1992 = 3.56, 1993 = 4.00, 1994 = 2.55 and 1995 = 8.36. The number of fawns observed in the study area that were not related to radio-collared does also varied from year to year, and these numbers were positively correlated to the amount of time spent in the field (Figure 2). The number of fawns from unmarked females varied from as few as 6 in 1992 to a many a 33 in 1995.

Table 2. Field hours expended during fawn surveys of radio-collared female mule deer during four consecutive years, 1992 to 1995, and the number of fawns unrelated to collared females observed.

Dates of Field Study	Approximate Field Hours Expended	Intensity[1] of Relocation Effort	No. of Fawns Unrelated to Radioed Does
Inclusive 1-4 and 8-12 June 1992	91	3.56	6
Inclusive 4-11 and 14-18 June 1993	189	4.0	24
Sporadic from 3 June to 19 July 1994	58	2.55	12
Inclusive 31 May to 30 June 1995	303	8.36	33

[1] *Intensity = total no. of relocations ÷ no. of available deer.*

Table 3. Efficiency at locating newborn fawns from a sample of radio-collared adult female mule deer observed during the fawning seasons 1992 to 1995.

Year	No. of Females with Radio Collars	No. Females Confirmed w/ or w/o Newborn Fawn(s)	Percent Success (observed/ available)
1992	16	4	25%
1993	16	12	75%
1994	22	11	50%
1995	14	14	100%

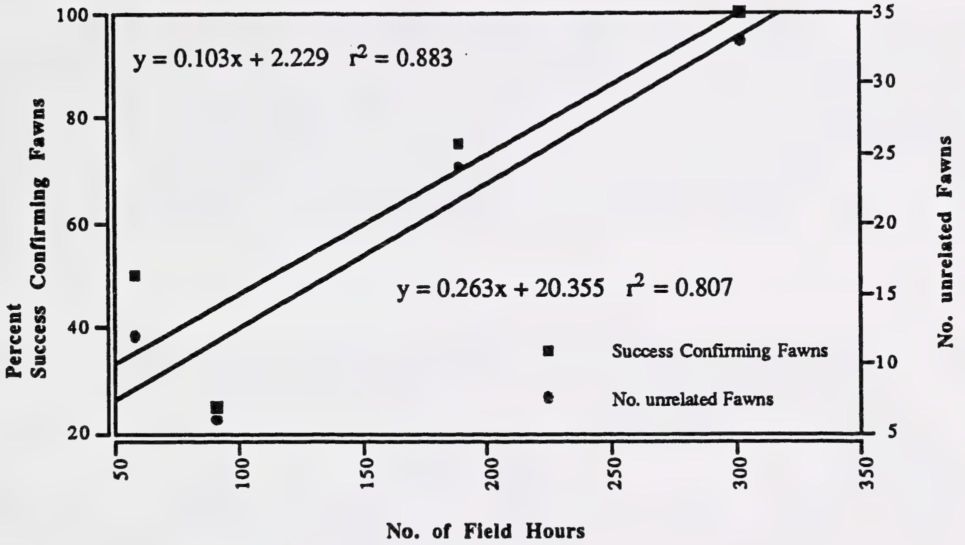

Figure 2. Success at confirming fawns with radio-collared females and observations of other unrelated fawns in the project area are positive correlates with field hours expended.

4.2 MORTALITY OF ADULT FEMALES

During four years of study, 26 adult female mule deer within the Oldman Reservoir project area were radio collared. This sample of marked deer provides a "window" for investigating adult female mortality. A first approximation is presented with reference to gross numbers, and without reference to ultimate causes of mortality. A more thorough treatment of this particular dataset is warranted, but it will be reserved for later publication when it can be investigated with more detail.

To review, mule deer were captured in clover traps and adult females were radio-collared during three consecutive winter seasons: February-March 1992, January 1993 and January-February 1994. Seventeen adult female mule deer were collared in February-March 1992 (Hornbeck and Balagus 1992a), two females were radio-collared during January 1993 (L. Morgantini, Project Biologist's files), and seven females were collared during January-February 1994 (Hornbeck 1994) (see Table 1).

Twelve (12) of 26 radio-collared adult female mule deer died during this 4-year study. This mortality seems to have occurred in two stages. Percent annual mortality rate on the cohort of 17 radio-collared female deer that were trapped in February -March 1992 was relatively low, estimated at about 12% {[(8 died ÷17 collared) ÷ 4 years] * 100}. Higher mortality on adult female mule deer occurred between 1994 and 1995, as evidenced by the fact that four of seven mule deer radio-collared in January-February 1994 did not survive to the 1995 fawning season (see Table 1).

4.3 CHRONOLOGY OF FAWNING

During four years of field study, parturition dates for 40 neonates were observed from 19 of 26 radio-collared females. Neonates were observed in the Oldman study area as early as 31 May (1995) and as late as 7 July (1994) (Table 4, Figure 3). The peak of fawn births appeared relatively stable among years, despite annual variation in parturition dates among individual females (Table 4). Typically, parturition by individual females varied by as much as 1 week between years, although this varied by as much as 19 days (e.g., deer #38). Birth of twin fawns generally appeared during the peak of fawning; there was only one early season birth of twin fawns during the four years of study (e.g., deer #Y8 - 31 May 1995).

Table 4. Mule deer parturition dates during four consecutive fawning seasons at the Oldman Reservoir, 1992 to 1995. (Blanks in table indicate no information).

Deer No./ Freq.	Fawning Season				Maximum Annual Variation (days)
	1992	1993	1994	1995	
6 - 148.731		15 June		25 June	10
7 - 149.921	9 June	12 June	22 June		13
8 - 149.951		15 June	9 June	15 June (2)[1]	6
13 - 150.095		14 June			
16 - 150.116				20 June	
22 - 150.014			14 June		
25 - 150.045	6 June	7 June		14 June (2)	8
26 - 150.055	11 June	16 June	16 June	19 June (2)	8
28 - 148.566		5 June			
35 - 150.073		14 June	12 June	26 June	14
38 - 150.083	12 June (2)	12 June (2)	1 July	19 June	19
39 - 150.263			15 June	13 June (2)	2
42 - 150.104		15 June	7 July		22
46 - 150.156		13 June			
47 - 150.164		17 June	30 June (3)	13 June (2)	17
51 - 150.206			14 June (2)	15 June	1
59 - 150.295				15 June	
62 - 150.194				24 June	
Y8 - 150.036			9 June (2)	31 May (2)	9
Mean Birth Date	9 June	12 June	19 June	16 June	
Mean Birth Date for Twins	12 June	12 June	17 June	12 June	

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[1] *No. in brackets indicates multiple fawn births; all other births were single fawns.*

These observations from the Oldman Reservoir in southwestern Alberta are in general agreement with information from Jasper National Park which indicated that most fawns in western Alberta were born in the second week of June (*in* Taylor 1956). The peak fawning period in Utah has been estimated at 19-20 June (Robinette *et al.* 1977, *in* Wallmo 1981), and in Colorado between 16 June and 6 July (Anderson and Medin 1967, *in* Wallmo 1981). A captive raised herd of mule deer in Colorado had a peak fawning period of 18 June (range, 26 May to 5 September) (Robinette *et al.* 1973). In Washington, Steigers and Flinders (1980) estimated the fawning period for mule deer to be from 25 May - 15 June with a peak on 29 May. Peak fawning period for mule deer in northcentral Montana was observed during mid-June (Riley and Dood 1984).

Based on peak fawning in mid-June and a gestation period of 200 to 208 days (Robinette *et al.* 1973; Anderson 1981; Anderson and Wallmo 1984), the peak of the mule deer rut at the Oldman Reservoir can be expected to occur in mid to late November (19 to 27 November).

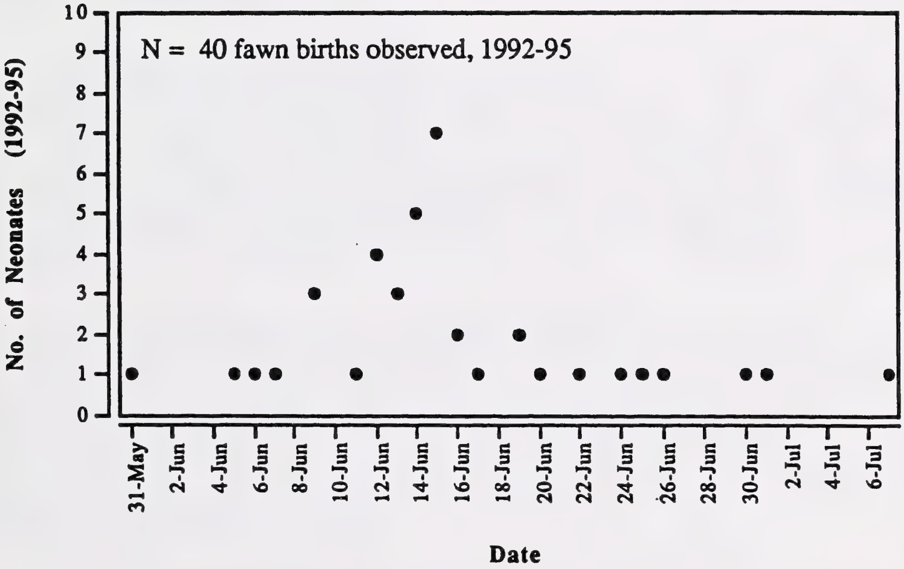

Figure 3. Birth dates for mule deer fawns born to radio-collared adult females observed during four consecutive fawning seasons at the Oldman Reservoir.

4.4 FIDELITY TO FAWNING AREAS

Fidelity is an expression of site attachment, or the tendency of an animal to return to a specific area. Fidelity is rated on a continuum varying from exclusive (specific to a given habitat patch), to localized (within same geographic location), to indifferent (random within home range). The issue of fidelity is addressed because fawning is considered to be a "critical" time of year when female habitat requirements are highly specific and related to the security needs of neonates. An understanding of habitat requirements during parturition

is basic ecological information that can be helpful for effective management. However, before addressing the issue of site fidelity, a more general discussion of mule deer distribution within the Reservoir project area is presented.

4.4.1 General Distribution During Parturition

All of the radio-collared deer were relocated during parturition either downstream of the Reservoir, or within one of three extremities of the Reservoir; the North Stem, the Crowsnest or the Castle (Figures 4 to 7). Only one radio-collared female and two unmarked females were observed to drop fawns in a area that could be considered the Main Stem of the Reservoir (see Figure 5 - 1993). This general distribution of radio-collared females in the project area may be an artifact of the trapping program whereby trapping efforts were concentrated in these areas. However, deer traps were set in the extremities of the Reservoir in order to maximize success (i.e., where most deer were observed). Four trap sites were established along the Main Stem of the Reservoir during winter 1993-94, but success at these sites was poor (Hornbeck 1994). Based on this general information, it appears that the Main Stem of the Reservoir does not provide high quality deer habitat, and specifically this part of the Reservoir does not provide suitable habitat for fawning. On a landscape scale, therefore, the upper arms of the Reservoir can be considered the "fawn factories" for this population. This may be a useful concept for broad scale landscape management of this population.

4.4.2 Fidelity to Specific Locations

The straight-line distance (estimated to within 100 m on 1:50,000 scale topographic maps) between neonate locations among years (N = 32) was used to estimate female fidelity to fawning areas. Distances ≤150 m between successive birth locations would imply exclusive fidelity, whereas birth locations ≥150 m between years would indicate varying degrees of site fidelity from localized to indifferent. The distance between fawns born during successive years was calculated (n = 19 paired comparison), as well as the distance between birth locations among alternate years (n = 13 additional comparisons) (Table 5).

Fidelity to fawning areas among females between successive years varied from exclusive to indifferent (Table 5). Exclusive fidelity to a given birth location appeared to be the exception, but widely scattered fawn birth locations among years were also rare events. One adult female (deer #51) was observed returning between 1994 and 1995 to drop her fawn in the same location (i.e., within 100 m). The majority of females (7/ 11 = 64%) dropped their fawns within 200 m to 1 km between successive years (average distance between successive years = 0.91 km excluding outlier deer #6 and #42 who were doing something different from the others).

Only three adult females were observed to drop their fawns at widely scattered locations between years (deer #6, #26 and #42); these deer showed indifference with regard to birth site fidelity. However, one of these observations occurred as a result of a dramatic shift in the center of a deer's home range (i.e., deer #6). Female #6 shifted her home range some time after the June 1994 fawning season. During the two years prior to summer 1994, deer #6 was consistently relocated on the south side of the Oldman River on the west side of the Summerview Bridge. After the 1994 fawning season, deer #6 moved from Summerview to an area along Kettle Creek, west of the Town of Pincher Creek. Female #26 dropped fawns at widely scattered locations (≥2 km) during two out of three successive fawning seasons. Deer #42 dropped her fawns 9.4 km apart between 1993 and 1994.

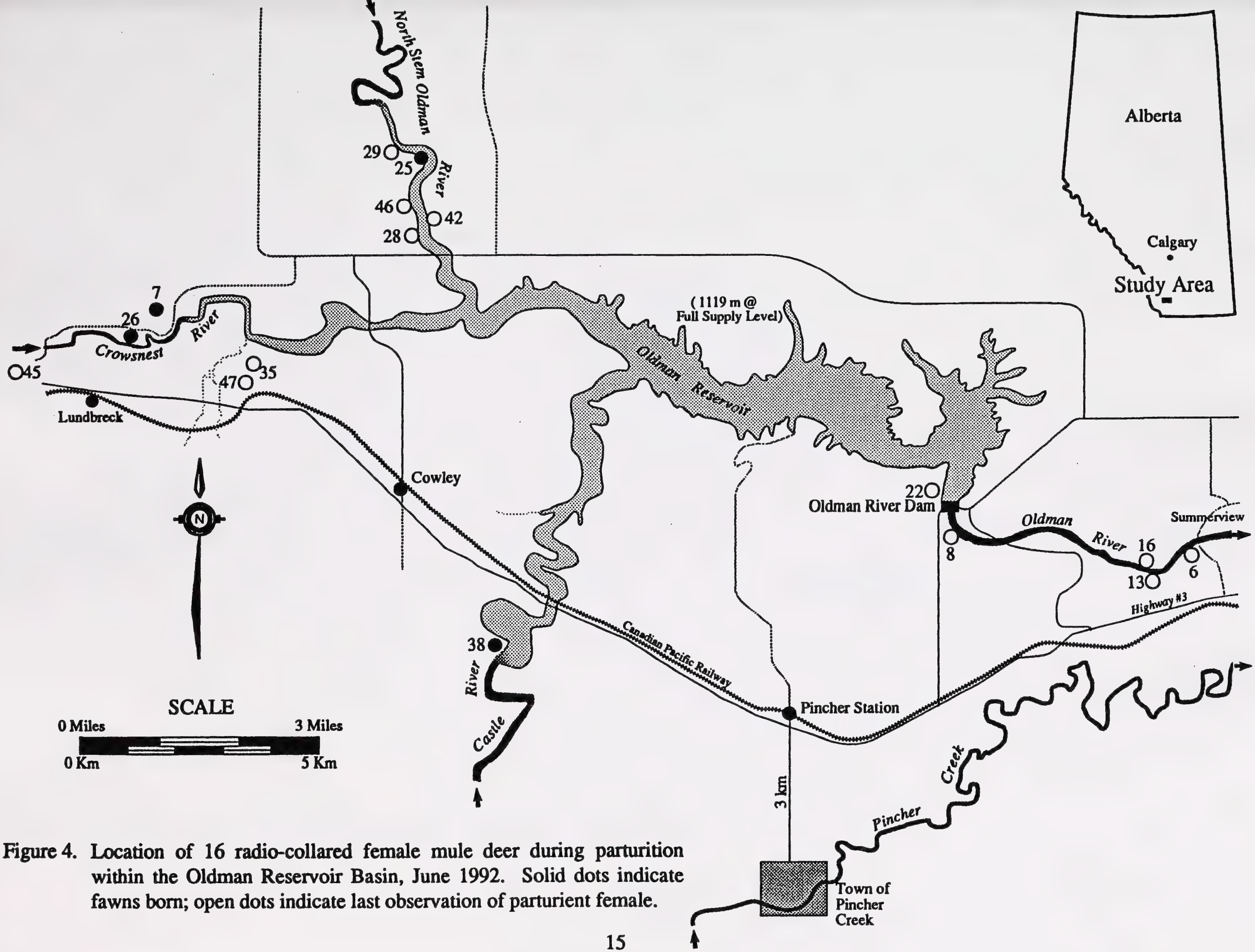

Figure 4. Location of 16 radio-collared female mule deer during parturition within the Oldman Reservoir Basin, June 1992. Solid dots indicate fawns born; open dots indicate last observation of parturient female.

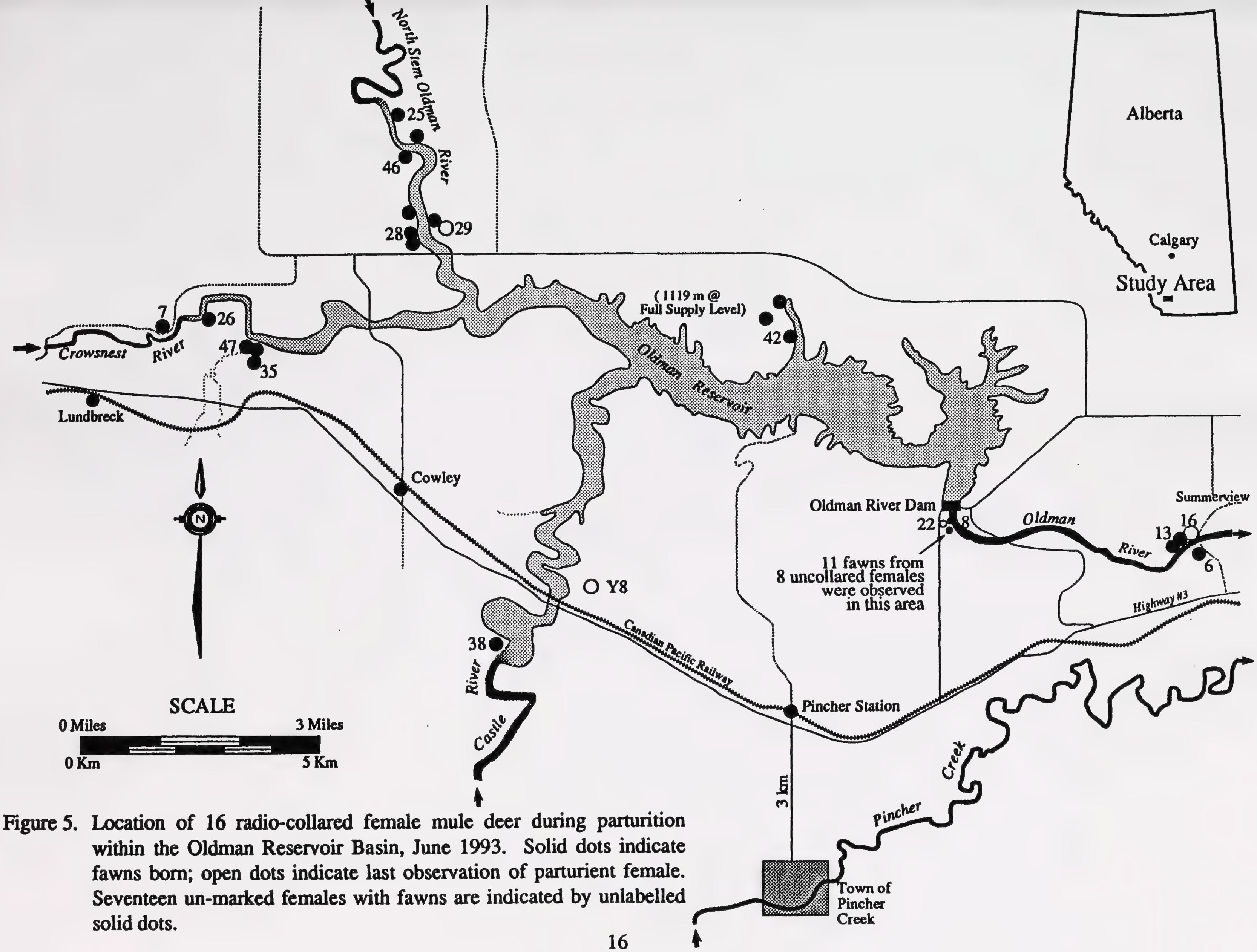

Figure 5. Location of 16 radio-collared female mule deer during parturition within the Oldman Reservoir Basin, June 1993. Solid dots indicate fawns born; open dots indicate last observation of parturient female. Seventeen un-marked females with fawns are indicated by unlabelled solid dots.

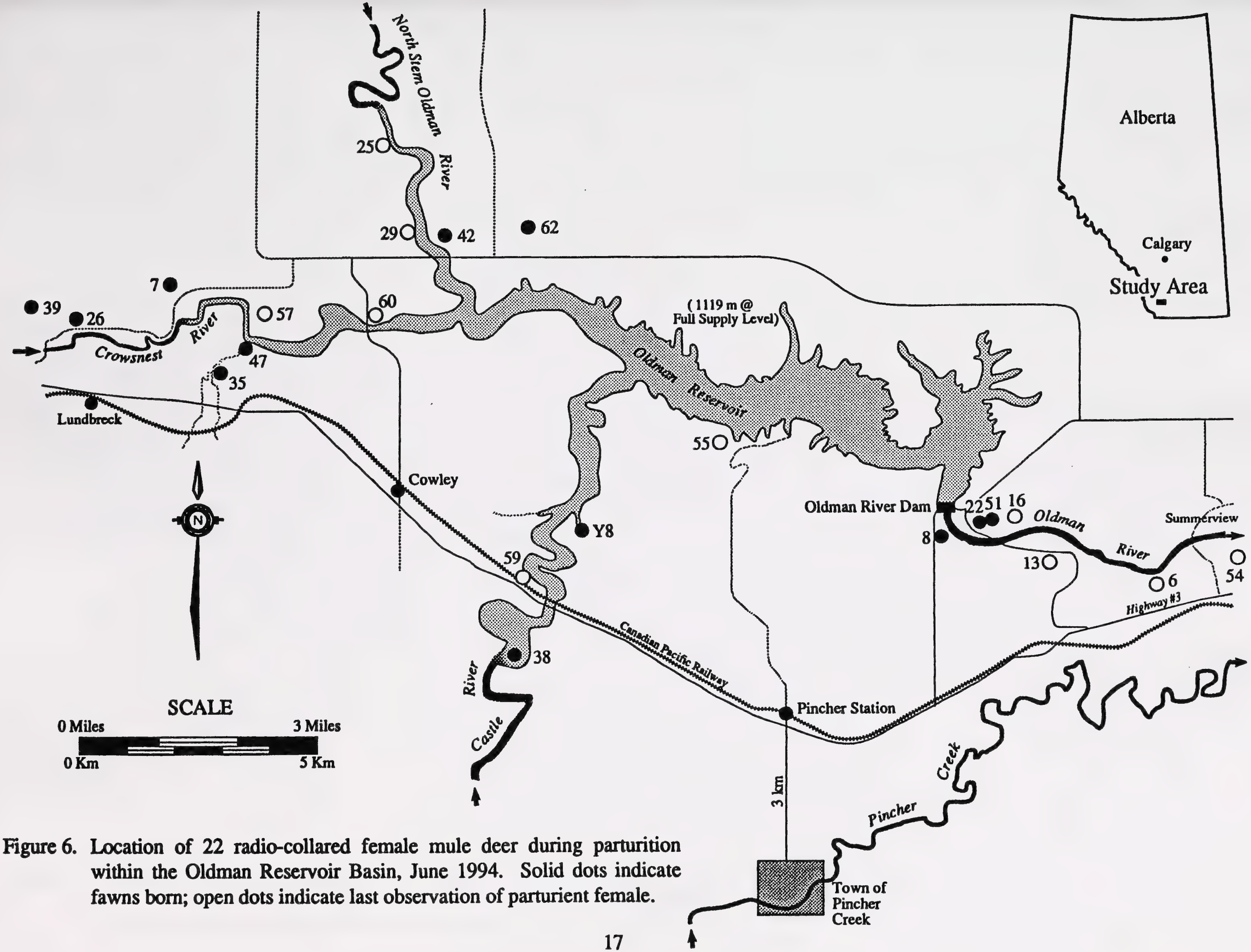

Figure 6. Location of 22 radio-collared female mule deer during parturition within the Oldman Reservoir Basin, June 1994. Solid dots indicate fawns born; open dots indicate last observation of parturient female.

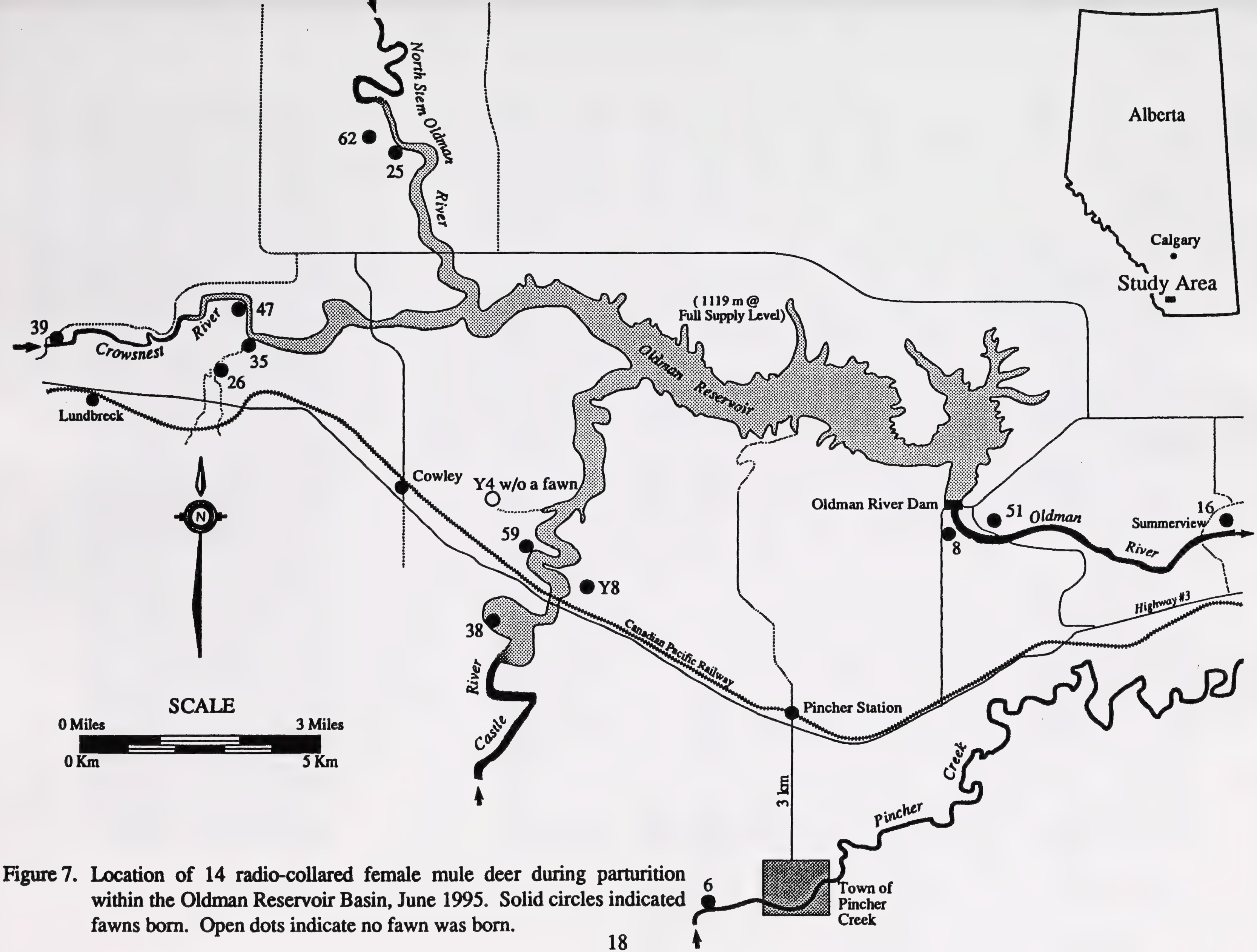

Figure 7. Location of 14 radio-collared female mule deer during parturition within the Oldman Reservoir Basin, June 1995. Solid circles indicated fawns born. Open dots indicate no fawn was born.

Table 5. Distance between fawn birth locations among years for radio-collared female mule deer at the Oldman Reservoir, 1992 to 1995.

Deer No./Freq.	Distance (km) Between Successive Years 1992-1993			Mean Among Succ. Yrs.	Distance (km) Between Alternate Years 1992-1994			Mean Among All Yrs.
	1992-1993	1993-1994	1994-1995		1992-1994	1992-1995	1993-1995	
6 -148.731							14.37	14.37
7 -149.921	0.72	0.92		0.82	1.00			0.88
8 -149.951		0.32	0.30	0.31			0.23	0.28
25 -150.045	0.85			0.85		0.41	0.71	0.66
26 -150.055	1.96	2.52	2.66	2.38	0.63	1.84	1.20	1.80
35 -150.073		0.22	1.00	0.61			0.78	0.67
38 -150.083	1.00	0.57	1.28	0.95	1.22	1.00	0.72	0.96
39 -150.263			0.81	0.81				0.81
42 -150.104		9.39		9.39				9.39
47 -150.164		0.22	1.00	0.61			0.92	0.72
51 -150.206			0.10	0.10				0.10
Y8 -150.036			1.39	1.39				1.39
Mean Distance	1.13	0.80[1]	1.07	0.91[1]	0.95	1.08	0.76[1]	0.90[1]

Note: Calculations conducted only between years in which fawns were positively identified. Deer not observed with fawns or observed only once with fawns during 4 years of study included: no.'s 13, 16, 22, 28, 29, 45, 46, 54, 55, 57, 59, 60, 62 and Y4.

[1] *Excluding obvious outlier value(s) within column.*

4.5 HABITAT USE

Forty (40) mule deer neonates (newborns) were observed over the course of four years of field study in all habitat types identified in the project area (Figure 8). The single largest percent of newborns were observed in upland grasslands (25%), followed by coulee shrublands (22%) and riparian cottonwood stands (18%). Sixty-five percent (65%) of all newborns were observed in these three habitat types. All of these important habitat types, with the exception of the upland grasslands, are physiographically associated with the river valley systems and coulees that lead into the Reservoir. Although there was no indication of deer using specific mitigation sites that are under development (although not fully investigated), all of the deer with radio-collars during fawning were residing within the mitigation landbase, including the mule deer downstream of the Dam and on Kettle Creek. Based on the information to date, it seems evident that the mitigation landbase currently contains the core fawning habitats for the mule deer in the Reservoir basin.

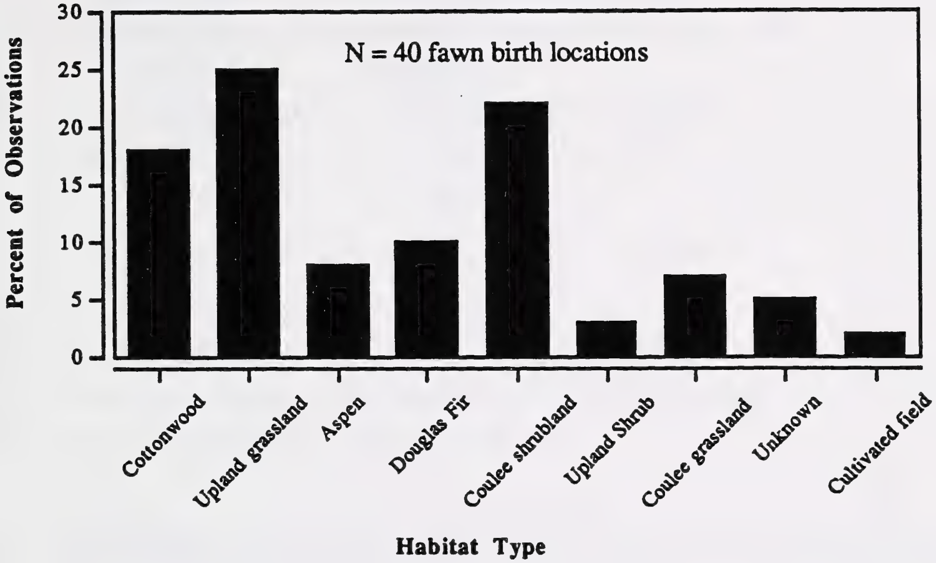

Figure 8. Habitats associated with mule deer neonates at the Oldman Reservoir, observed during fawn studies June 1992 to 1995.

4.6 HERD PRODUCTIVITY

Herd productivity is discussed with the use of different statistics that are buried within the available information. Three kinds of estimates are presented: the aggregate number of fawns per doe within each year, twinning rate, and individual reproductive performance, fawns per doe per year.

For all years, ninety-eight percent (40 ÷ 41 = .975) of radio-collared females that were followed closely throughout the fawning season produced at least one fawn each year. This indicates maximum pregnancy rates have been near 100% at the Oldman Reservoir, and that most if not all adult females are being impregnated by available males. The only exception was deer #Y4, which very likely did not bear a fawn during 1995 (Appendix Table 1). Deer #Y4 was relocated by close approach on eight different occasions during the 1995 reproductive season (Appendix Table 2). Productivity (fawns per female) appeared to vary year to year, with the highest estimates obtained during the last two years of study at 1.36 fawns per female in both 1994 and 1995 (Table 6). The relatively low productivity estimate during 1993 stands out among years, but there is no readily available explanation for this low value. It is instructive to note that the sample size for this estimate was comparable to the subsequent two years, and field effort during 1993 was also relatively high.

Based on individual female reproductive performance over the years, mule deer productivity was estimated to vary from 1.33 fawns/ female/ year to 1.50 fawns/ female/ year, depending on how the available information is presented (Table 7). Birth of fawns was not positively identified during 4 years of study for deer #29, 45, 54, 55, 57, and 60.

Table 6. Reproductive parameters of radio-collared mule deer during four consecutive fawning seasons at the Oldman Reservoir, 1992 to 1995.

Year	No. Females Observed w/Fawns	Total Fawns Born (no. twins)	Fawns/ Female	Percent Twins[1]
1992	4	5 (1)	1.25	25% (1/4)
1993	12	13 (1)	1.08	8% (1/12)
1994	11	15 (3)	1.36	27% (3/11)
1995	14	19 (6)	1.36	43% (6/14)

[1] *Percent twins = no. of twins ÷ no. females with fawns.*

Of all females known to have produced fawns, 40% (8 ÷ 20= .40) gave birth to twins. Three of these deer produced twins in consecutive years: #38 (1992 and 1993), #47 (1994 and 1995), and #Y8 (1994 and 1995). The number of females that produced twins in a given year was highest in 1995 (Table 6). The twinning rate (another index of productivity) is the ratio of the number of females that produced twin fawns divided by the number of females that produced fawns. This ratio varied more-or-less with the fawn/ female ratio being lowest during 1993 (8%) and highest during 1995 at 43% (Table 6). One set of triplets were observed during the four years of study (deer #47, 1994) (Appendix Table 1). Sixty percent twinning rate for mule deer has been reported, however, triplets are known to be relatively rare (Mackie *et al.* 1982).

The highest reproductive rate known for either white-tailed deer or mule deer is about 1.90 (Robinette *et al.* 1973). The reported range for mule deer is 1.4 to 1.8 fawns/ female (Mackie *et al.* 1982). In an representative prairie environment in eastern Montana, mule deer herd litter sizes for female fawns averaged 1.50, 1.43, 1.29, 1.27 and 1.54 during July 1982 to 1986, respectively, indicating that productivity of this eastern Montana herd was generally high (Wood *et al.* 1989).

Table 7. Reproductive performance by individual adult female mule deer at the Oldman Reservoir over 4 years of study, 1992 to 1995.

	No. of Fawns Born (no. twins)		
Deer #	4 Consecutive Years of Information	Three Years of Information	Two Years of Information
6			2 (0)
7		3 (0)	
8		4 (1)	
25		4 (1)	
26	5 (1)		
35		3 (0)	
38	6 (2)		
39			3 (1)
47		6 (2)	
51			3 (1)
Y8			4 (2)
Mean (fawn/F/yr)	1.38	1.33	1.50

5.0 SUMMARY AND CONCLUSION

The field technique needed and prescribed for this study was demanding in terms of the required intensity of field study and overall acumen required of the biologist with radio-telemetry. In order to obtain complete information, the field biologist had to "circulate" among collared deer on a regular, closely-spaced schedule so as to arrive within a day or two of each fawn's birth. In doing so, the field biologist required a considerable measure of sensitivity for interpreting the signal characteristics of individual radio collars in order to obtain close observation without disturbing the deer. The results demonstrate that long field hours were required in order to attain a high degree of success at locating newborn fawns. Several positive correlates with the number of field hours expended were identified, such as success at confirming birth of fawns from individual deer, and the discovery of fawns born to unmarked females.

Given the size of the mule deer population and the total number of fawns that were dropped in the study area, it is surprising that so few fawns from unmarked females were observed in the project area. This fact demonstrates the effectiveness of the "hider strategy" whereby fawns, aided by a cryptic coat pattern, lay motionless for long hours at a time for the first 6 to 8 weeks of life. Without radio-collared females, it would be difficult to predict the success of attempting to locate newborns because they will not readily flush out of their beds.

Although this study spanned four reproductive seasons, complete information on the reproductive history of radio-collared mule deer was obtained for only a small percentage of collared deer. In other words, not all available radio-collared deer were confirmed each year to have produced or not to have produced a fawn. The reasons for this shortfall relate to variations in the intensity of field work that was conducted each year. The result of varying field work intensity year to year was a diminished return of information, inherent in part with field research conducted with relatively small sample sizes. Nevertheless, recognizing the limitations of small sample sizes, available pieces of information have been brought together for a description of the status of the mule deer population and female behavior during fawning.

Based on the cohort of 17 radio-collared adult female during the first year of study (1992), the percent annual mortality to 1995 was estimated to be about 12%. By most standards, this is low adult mortality. At the other end of the population dynamics balance sheet, reproductive rates of adult females have been observed to be relatively high. At least in 1995, practically all adult female deer gave birth to at least one fawn. Predation on neonates appears to be relatively light, as it has gone unnoticed during four years of field work during the fawning season. These three pieces of information suggest that the Oldman mule deer population is likely increasing in size.

Birth of fawns has been established for this population in southwestern Alberta to occur with a broad peak around mid-June, fawns being born as early as late May and into July. Exclusive fidelity to a particular birth site was rarely observed, although parturient females tended to drop fawns within an area ≤ 0.9 km of each other year to year. In terms of annual home range movements (presumably much larger than distance between successive fawn locations, but to date not studied with detail), it appears that the majority of deer return to the same portion of the home range each year to drop fawns. It should be noted, however, that annual home range movements are not well defined for this population except that the mule deer are generally known to be non-migratory. Discrete or

localized "fawning areas" therefore cannot be identified because selection for such sites is more generalized and occurs on a larger scale and related to the individual's home range.

Habitat use during fawning tended to be generalized in that fawns were born in all habitat types of the study area. Most fawns, however, were born in one of three habitat types in the following order of importance; either upland grasslands, coulee shrublands or riparian cottonwood stands. The use of coulee shrublands and riparian cottonwoods are habitat types peculiar to the upper river reaches of the Reservoir. These habitat types are not widespread in the study area and specifically do not occur to any great extent along the Main Stem where the Reservoir edge merges more or less smoothly with grassland habitat. It seems apparent that most of the parturient females depend on upper areas of the Reservoir during fawning for these habitat features. On a landscape scale, it may be useful to view these upper reaches of the Reservoir as mule deer "fawn factories."

6.0 LITERATURE CITED

Alberta Agriculture. 1991. Census of agriculture for Alberta. Statistics Branch, Edmonton. 170pp.

Anderson, A.E. 1981. Morphological and physiological characteristics. Pp. 27-97. *In* Wallmo, O. C. (ed.). Mule and black-tailed deer of North America. University of Nebraska Press, Lincoln. 605pp.

Anderson, A.E. and O.C. Wallmo. 1984. *Odocoileus hemionus*. Mammalian Species, No. 219, pp. 1-9. The American Society of Mammalogists.

Connolly, G.E. 1981. Limiting factors and population regulation. Pp. 245-285. *In* Wallmo, O.C. (ed.). Mule and black-tailed deer of North America. University of Nebraska Press, Lincoln. 605pp.

Geist, V. 1981. Behavior: adaptive strategies in mule deer. Pp. 157-223. *In* Wallmo, O.C. (ed.). Mule and black-tailed deer of North America. University of Nebraska Press, Lincoln. 605pp.

Hornbeck, G.E. and P. Balagus. 1992a. Oldman Mule Deer Studies - Progress Report on Capture and Radio-collaring, Winter 1991-92. Prepared for Alberta Public Works, Supply and Services. The Delta Environmental Management Group Ltd, Calgary, Alberta. 26pp.

Hornbeck, G.E. and P. Balagus. 1992b. Oldman Reservoir Mule Deer Studies - Progress Report on Fawn Studies, 1 - 12 June 1992. Prepared for Manager, Wildlife Mitigation Program, Alberta Public Works, Supply and Services, Edmonton, Alberta. Prepared by The Delta Environmental Management Group Ltd., Calgary, Alberta. 29pp.

Hornbeck, G.E., P. Balagus, and R.D. Lauzon. 1993. Oldman Reservoir Mule Deer Studies - Progress Report on Fawn Studies, 4 - 18 June 1993. Prepared for Manager, Wildlife Mitigation Program, Alberta Environmental Protection, Fish and Wildlife Service, Lethbridge, Alberta. Prepared by The Delta Environmental Management Group Ltd., Calgary, Alberta. 26pp.

Hornbeck, G.E. 1994. Oldman Reservoir Mule Deer Studies - Capture and Radio-collaring, Winter 1993-94. Prepared for John Mahoney, Project Biologist, Alberta Environmental Protection, Development and Operations Division, Water Management Headworks Branch, Pincher Creek, Alberta. Prepared by Axys Environmental Consulting Ltd., Calgary, Alberta. 21pp.

Hornbeck, G.E. and P. Balagus. 1994. Aerial survey of the Oldman Reservoir, southwestern Alberta, 28 February and 1 March 1994. Prepared by the Axys Environmental Consulting Ltd. for Alberta Environmental Protection, Development and Operations Division, Water Management Headworks Branch, Pincher Creek. 29pp.

Mackie, R.J., K.L. Hamlin, and D.F. Pac. 1982. Mule deer. Pp. 862-877. *In* J.A. Chapman and G.A. Feldhamer (eds.). Wild Mammals of North America - biology, management and economics. The Johns Hopkins University Press, Baltimore and London. 1147pp.

Reid, D.E., C. Thompson, and H. Martens. 1985. Phase II vegetation study - Oldman River Dam. Hardy Associates Ltd., Calgary. Prepared for Alberta Environment, Planning Division, Edmonton, Alberta.

Riley, S.J. and A.R. Dood. 1984. Summer movements, home range, habitat use and behavior of mule deer fawns. J. Wildl. Manage. 48(4):1302- 1310.

Robinette, W. L., C. H. Baer, R.E. Pillmore and C.E. Knittle. 1973. Effects of nutritional change on captive mule deer. J. Wildl. Manage. 37(3):312- 326.

Steigers, William D. Jr. and Jerran T. Flinders. 1980. Mortality and movements of mule deer fawns in Washington. J. Wildl. Manage. 44(2) : 381-388.

Strong, W.L. and K.R. Leggat. 1992. Ecoregions of Alberta. Prepared for Alberta Forestry, Lands and Wildlife, Land Information Services Division, Resources Information Branch. 59pp.

Taylor, W.P. (ed.). 1956. The deer of North America - the white-tailed, mule and black-tailed deer - their history and management. The Stackpole Co., Harrisburg, PA. 668pp.

Wallmo, O.C. (ed.) 1981. Mule and black-tailed deer of North America. University of Nebraska Press, Lincoln. 605pp.

White, Marshall, Frederick F. Knowlton and W.C. Glazener. 1972. Effects of dam-newborn behavior on capture and mortality. J. Wildl. Manage. 36(3) : 897-906.

Wood, A.K., R.J. Mackie and K.L. Hamlin. 1989. Ecology of sympatric populations of mule deer and white-tailed deer in a prairie environment. Montana Department of Fish, Wildlife and Parks, Bozeman. 97pp.

7.0 APPENDIX

Appendix Table 1. Observations of radio-collared female mule deer at the Oldman Reservoir during parturition, 1992 to 1995.

Deer No./Freq.	Year	No. of Fawns	Date Fawn(s) Observed	Est. Age of Fawns (days)	Estimated Birth Date	Location of Fawns		Habitat Type	General Reservoir Location
						Easting	Northing		
6 - 148.731	1992					Last relocation 11 June and no fawn(s)			Summerview
6	1993	1	16-Jun-93	1	15-Jun-93	29.8	92.8	Cottonwood	Summerview
6	1994					Relocations 7 and 17 June and 11 July and no fawn(s)			Summerview
6	1995	1	30-Jun-95	5	25-Jun-95	18.6	83.8	Upland pasture	Pincher Creek
7 - 149.921	1992	1	9-Jun-92	< 1	9-Jun-92	6.3	98.2	Aspen	Crowsnest River
7	1993	1	15-Jun-93	3	12-Jun-93	6.7	97.6	Cottonwood	Crowsnest River
7	1994	1	23-Jun-94	< 2	22-Jun-94	7.3	98.3	Upland pasture	Crowsnest River
8 - 149.951	1992					Last relocation 8 June and no fawn(s)			Spillway
8	1993	1	18-Jun-93	3	15-Jun-93	24.5	93.7	Douglas Fir	Spillway
8	1994	1	13-Jun-94	4	9-Jun-94	24.4	93.4	Coulee shrubland	Spillway
8	1995	2	16-Jun-95	1	15-Jun-95	24.3	93.7	Douglas Fir	Spillway
13 - 150.095	1992					Last relocation 9 June and no fawn(s)			Summerview
13	1993	1	16-Jun-93	2	14-Jun-93	29.4	93.1	Cottonwood	Summerview
13	1994					Relocations 7 June and 7 July and no fawn(s)			Downstream
16 - 150.116	1992					Last relocation 8 June and no fawn(s)			Summerview
16	1993					Last relocation 10 June and no fawn(s)			Summerview
16	1994					Relocations 7 June and 5 July and no fawn(s)			Downstream
16	1995	1	30-Jun-95	<11	20-Jun-95	31.3	93.1	Cottonwood	Summerview

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Deer No./Freq.	Year	No. of Fawns	Date Fawn(s) Observed	Est. Age of Fawns (days)	Estimated Birth Date	Location of Fawns Easting	Location of Fawns Northing	Habitat Type	General Reservoir Location
22 - 150.014	1992					Last relocation 8 June 1992 and no fawn(s)			Spillway
22	1993					Last relocation 18 June and no fawn(s)			Spillway
22	1994	1	15-Jun-94	< 2	14-Jun-94	24.5	93.0	Aspen	Downstream
25 - 150.045	1992	1	6-Jun-92		6-Jun-92	12.0	101.7	Cottonwood	North Stem
25	1993	1	8-Jun-93	1	7-Jun-93	11.7	102.5	Cottonwood	North Stem
25	1994					Relocations 3 and 24 June and no fawn(s)			North Stem
25	1995	2	16-Jun-95	2	14-Jun-95	11.6	101.8	Coulee shrubland	North Stem
26 - 150.055	1992	1	11-Jun-92	< 1	11-Jun-92	5.5	97.3	Cottonwood	Crowsnest River
26	1993	1	17-Jun-93	1	16-Jun-93	7.4	97.8	Upland Shrub	Crowsnest River
26	1994	1	23-Jun-94	7	16-Jun-94	4.9	97.5	Coulee shrubland	Crowsnest River
26	1995	2	20-Jun-95	1	19-Jun-95	7.4	96.6	Coulee grassland	Crowsnest River
28 - 148.566	1992					Last relocation 10 June and no fawn(s)			North Stem
28	1993	1	6-Jun-93	1	5-Jun-93	12.0	100.3	Coulee shrubland	North Stem
29 - 150.064	1992					Last relocation 3 June and no fawn(s)			North Stem
29	1993					Last relocation 8 June and no fawn(s)			North Stem
29	1994					Relocations 3 and 23 June and 14 July and no fawn(s)			North Stem
35 - 150.073	1992					Last relocation 11 June and no fawn(s)			Crowsnest River
35	1993	1	14-Jun-93	< 1	14-Jun-93	7.7	97.0	Douglas Fir	Crowsnest River
35	1994	1	13-Jun-94	< 2	12-Jun-94	7.5	96.9	Upland pasture	Crowsnest River
35	1995	1	29-Jun-95	3	26-Jun-95	8.3	97.5	Coulee shrubland	Crowsnest River

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Deer No./Freq.	Year	No. of Fawns	Date Fawn(s) Observed	Est. Age of Fawns (days)	Estimated Birth Date	Location of Fawns		Habitat Type	General Reservoir Location
						Easting	Northing		
38 - 150.083	1992	2	12-Jun-92	< 1	12-Jun-92	13.7	90.7	Coulee grassland	Castle River
38	1993	2	14-Jun-93	2	12-Jun-93	14.5	91.3	Upland pasture	Castle River
38	1994	1	19-Jul-94	≈ 19	1-Jul-94	14.9	90.9	Unknown	Castle River
38	1995	1	20-Jun-95	1	19-Jun-95	13.9	91.7	Upland pasture	Castle River
39 - 150.263	1994	1	27-Jun-94	≈ 12	15-Jun-94	3.2	97.8	Upland pasture	Crowsnest River
39	1995	2	13-Jun-95	< 1	13-Jun-95	3.6	97.1	Coulee shrubland	Crowsnest River
42 - 150.104	1992				Last relocation 12 June and no fawn(s)				North Stem
42	1993	1	17-Jun-93	2	15-Jun-93	20.8	98.2	Coulee shrubland	Tennessee Coulee
42	1994	1	7-Jul-94	< 1	7-Jul-94	12.3	102.2	Douglas Fir	North Stem
45 - 150.124	1992				Last relocation 10 June and no fawn(s)				Crowsnest River
46 - 150.156	1992				Last relocation 12 June and no fawn(s)				North Stem
46	1993	1	17-Jun-93	4	13-Jun-93	11.7	101.7	Aspen	North Stem
47 - 150.164	1992				Last relocation 11 June 1992 and no fawn(s)				Crowsnest River
47	1993	1	18-Jun-93	1	17-Jun-93	8.0	97.4	Coulee shrubland	Crowsnest River
47	1994	3	7-Jul-94	< 7	30-Jun-94	8.2	97.3	Upland pasture	Crowsnest River
47	1995	2	14-Jun-95	1	13-Jun-95	8.2	98.3	Upland pasture	Crowsnest River
51 - 150.206	1994	2	21-Jun-94	< 7	14-Jun-94	25.1	93.8	Upland pasture	Spillway
51	1995	1	16-Jun-95	1	15-Jun-95	25.2	93.7	Coulee grassland	Spillway
54 - 150.555	1994				Relocations on 7 and 21 June (no visual) and no fawn(s)				Summerview

Appendix Table 1. Observations of radio-collared female mule deer at the Oldman Reservoir during parturition, 1992 to 1995.

Deer No./Freq.	Year	No. of Fawns	Date Fawn(s) Observed	Est. Age of Fawns (days)	Estimated Birth Date	Location of Fawns		Habitat Type	General Reservoir Location
						Easting	Northing		
55 - 150.303	1994					Relocations on 10 June and 11 July and no fawn(s)			Castle River
57 - 150.023	1994					Only relocation 14 June (no visual) and no fawn(s)			Crowsnest River
59 - 150.295	1994					Last relocation 27 June and no fawn(s)			Castle River
59	1995	1	17-Jun-95	2	15-Jun-95	15.2	93.2	Coulee shrubland	Castle River
60 - 150.314	1994					Relocations 10 June and 27 June and no fawn(s)			Crowsnest River
62 - 150.194	1994					Relocations on 3 and 27 June and no fawn(s)			North Stem
62	1995	1	26-Jun-95	2	24-Jun-95	10.8	102.3	Cultivated field	North Stem
Y4 - 150.184	1995	0				Relocated on 8 different days in June and no fawn(s)			Castle River
Y8 - 150.036	1993					Last relocation 18 June and no fawn(s)			Castle River
Y8	1994	2	10-Jun-94	< 2	9-Jun-94	15.9	94.1	Unknown	Castle River
Y8	1995	2	1-Jun-95	1	31-May-95	16.4	92.8	Upland pasture	Castle River

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location Easting	Local UTM Location Corrected Easting	Local UTM Location Northing	No./ Date Fawn(s) Observed	Habitat Description
Deer No. 6 - 148.731 MHz						
2-Jun-92	6	95.9	29.9	92.8		Cottonwood
3-Jun-92	6	95.9	29.9	92.8		Cottonwood
4-Jun-92	6	95.4	29.4	92.5		Aspen
8-Jun-92	6	95.2	29.2	92.4		Coulee Shrubland
9-Jun-92	6	94.3	28.3	92.3		Upland shrub
11-Jun-92	6	95.7	29.7	92.8		Coulee Shrubland
5-Jun-93	6	93.9	27.9	92.3		Coulee Shrubland
7-Jun-93	6	94.7	28.7	92.3		Coulee Shrubland
10-Jun-93	6	95.7	29.7	92.7		Cottonwood
16-Jun-93	6	95.8	29.8	92.8	1	Cottonwood
7-Jun-94	6	94.2	28.2	92.5		Cottonwood
17-Jun-94	6	94.7	28.7	92.3		Aspen
11-Jul-94	6	92.9	26.9	93.1		Cottonwood
1-Jun-95	6	84.6	18.6	83.4		Coulee Shrubland
5-Jun-95	6	84.6	18.6	83.5		Coulee Shrubland
8-Jun-95	6	84.8	18.8	83.4		Upland grassland
9-Jun-95	6	84.7	18.7	83.8		Coulee Shrubland
12-Jun-95	6	84.8	18.8	83.7		Coulee Shrubland
15-Jun-95	6	84.6	18.6	83.5		Coulee Shrubland
16-Jun-95	6	84.7	18.7	83.8		Coulee Shrubland
20-Jun-95	6	84.8	18.8	83.8		Coulee Shrubland
21-Jun-95	6	84.6	18.6	83.8		Coulee Shrubland
22-Jun-95	6	84.8	18.8	83.7		Coulee Shrubland
23-Jun-95	6	84.8	18.8	83.8		Coulee Shrubland
27-Jun-95	6	84.6	18.6	83.5		Coulee Shrubland
28-Jun-95	6	84.7	18.7	83.8		Coulee Shrubland
30-Jun-95	6	84.6	18.6	83.8	1	Upland grassland
Deer No. 7 - 149.921						
2-Jun-92	7	6.2	6.2	98.3		Coulee Shrubland
9-Jun-92	7	6.3	6.3	98.2	1	Aspen
6-Jun-93	7	5.9	5.9	97.3		Cottonwood
8-Jun-93	7	5.9	5.9	97.3		Cottonwood
10-Jun-93	7	5.9	5.9	97.4		Coulee Shrubland
15-Jun-93	7	6.7	6.7	97.6	1	Cottonwood

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location Easting	Corrected Easting	Northing	No./ Date Fawn(s) Observed	Habitat Description
3-Jun-94	7	6.9	6.9	97.8		Cottonwood
23-Jun-94	7	7.3	7.3	98.3	1	Upland grassland
8-Jul-94	7	6.8	6.8	98.1		Aspen coulee mitigation proj.
14-Jul-94	7	7.0	7.0	98.0		Upland grassland
Deer No. 8 - 149.951						
3-Jun-92	8	90.0	24.0	93.2		Douglas Fir
8-Jun-92	8	90.2	24.2	93.4		Grassland coulee
4-Jun-93	8	90.2	24.2	93.7		Douglas Fir
5-Jun-93	8	90.3	24.3	93.7		Coulee Shrubland
7-Jun-93	8	90.4	24.4	93.2		Upland grassland
8-Jun-93	8	90.2	24.2	93.7		Douglas Fir
11-Jun-93	8	90.4	24.4	93.4		Upland grassland
16-Jun-93	8	90.3	24.3	93.7		Douglas Fir
18-Jun-93	8	90.0	24.0	93.6	1	Douglas Fir
7-Jun-94	8	90.3	24.3	93.4		Douglas Fir
13-Jun-94	8	90.4	24.4	93.4	1	Coulee Shrubland
16-Jun-94	8	91.4	25.4	93.4		Upland grassland
30-Jun-94	8	90.1	24.1	93.8		Upland grassland
5-Jun-95	8	90.1	24.1	93.7		Coulee Shrubland
7-Jun-95	8	90.3	24.3	93.7		Coulee grassland
12-Jun-95	8	90.3	24.3	93.3		Douglas Fir
15-Jun-95	8	90.2	24.2	93.7		Douglas Fir
16-Jun-95	8	90.3	24.3	93.7	2	Douglas Fir
22-Jun-95	8	90.6	24.6	93.3		Coulee grassland
Deer No. 13 - 150.095						
2-Jun-92	13	94.1	28.1	92.5		Cottonwood
3-Jun-92	13	94.1	28.1	92.5		Coulee Shrubland
4-Jun-92	13	94.6	28.6	92.3		Aspen
9-Jun-92	13	94.5	28.5	92.2		Upland shrub
5-Jun-93	13	93.9	27.9	92.3		Coulee Shrubland
7-Jun-93	13	94.0	28.0	92.3		Upland Shrub
10-Jun-93	13	94.2	28.2	92.3		Upland grassland
16-Jun-93	13	95.4	29.4	93.1	1	Cottonwood

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location Easting	Corrected Easting	Northing	No./ Date Fawn(s) Observed	Habitat Description
7-Jun-94	13	92.3	26.3	92.3		unknown
7-Jul-94	13	92.6	26.6	94.0		Upland mitigation proj.
Deer No. 16 - 150.116						
2-Jun-92	16	96.1	30.1	93.4		Cottonwood
3-Jun-92	16	95.7	29.7	93.3		Cottonwood
4-Jun-92	16	95.8	29.8	93.1		Aspen
8-Jun-92	16	94.5	28.5	92.7		Cottonwood
7-Jun-93	16	89.1	23.1	94.7		Upland grassland
10-Jun-93	16	95.6	29.6	93.4		Coulee Shrubland
7-Jun-94	16	92.4	26.4	94.1		Upland grassland
5-Jul-94	16	93.1	27.1	94.0		Cultivated
7-Jun-95	16	96.1	30.1	93.4		Cottonwood
12-Jun-95	16	96.7	30.7	93.4		Cottonwood
15-Jun-95	16	95.9	29.9	93.4		Cottonwood
19-Jun-95	16	97.5	31.5	93.5		Cottonwood
21-Jun-95	16	96.5	30.5	93.3		Cottonwood
23-Jun-95	16	96.5	30.5	93.5		Cottonwood
27-Jun-95	16	97.3	31.3	93.1		Cottonwood
29-Jun-95	16	97.2	31.2	93.6		Cottonwood
30-Jun-95	16	96.2	30.2	93.5	1	Cottonwood
Deer No. 22 - 150.014 MHz						
2-Jun-92	22	89.9	23.9	935.0		Coulee Shrubland
3-Jun-92	22	90.0	24.0	932.0		Douglas Fir
8-Jun-92	22	88.6	22.6	944.0		Upland shrub
5-Jun-93	22	88.7	22.7	95.0		Douglas Fir
7-Jun-93	22	88.6	22.6	94.6		Upland Shrub
9-Jun-93	22	88.4	22.4	94.6		Coulee Shrubland
11-Jun-93	22	90.2	24.2	93.3		Coulee grassland
16-Jun-93	22	89.9	23.9	93.6		Upland grassland
18-Jun-93	22	90.0	24.0	93.6		Upland grassland
7-Jun-94	22	91.1	25.1	93.7		Upland grassland
15-Jun-94	22	90.5	24.5	93.0	1	Aspen
16-Jun-94	22	90.1	24.1	92.9		Coulee grassland
14-Jul-94	22	90.8	24.8	94.0		Upland grassland

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location Easting	Local UTM Location Corrected Easting	Local UTM Location Northing	No./ Date Fawn(s) Observed	Habitat Description
Deer No. 25 - 150.045						
2-Jun-92	25	11.6	11.6	101.6		Cottonwood
3-Jun-92	25	11.6	11.6	101.6		Cottonwood
6-Jun-92	25	12.0	12.0	101.7	1	Cottonwood
6-Jun-93	25	12.0	12.0	102.8		Coulee grassland
8-Jun-93	25	11.7	11.7	102.5	1	Cottonwood
3-Jun-94	25	11.9	11.9	102.6		Douglas Fir
24-Jun-94	25	11.7	11.7	102.2		Douglas Fir
7-Jun-95	25	11.6	11.6	102.3		Coulee Shrubland
12-Jun-95	25	12.2	12.2	101.4		Upland grassland
14-Jun-95	25	12.2	12.2	101.6		Upland grassland
16-Jun-95	25	11.6	11.6	101.8	2	Coulee Shrubland
Deer No. 26 - 150.055						
2-Jun-92	26	6.4	6.4	97.1		Coulee Shrubland
4-Jun-92	26	5.3	5.3	97.3		Cottonwood
11-Jun-92	26	5.5	5.5	97.3	1	Cottonwood
6-Jun-93	26	6.6	6.6	98.3		Upland grassland
8-Jun-93	26	6.9	6.9	98.1		Aspen
10-Jun-93	26	7.0	7.0	97.8		Cottonwood
17-Jun-93	26	7.4	7.4	97.8	1	Upland shrub
3-Jun-94	26	5.0	5.0	97.2		Cottonwood
23-Jun-94	26	4.9	4.9	97.5	1	Coulee Shrubland
30-Jun-94	26	6.9	6.9	98.2		no visual
1-Jun-95	26	7.3	7.3	97.8		Coulee Shrubland
6-Jun-95	26	6.9	6.9	98.2		Aspen
7-Jun-95	26	6.3	6.3	97.8		Aspen
9-Jun-95	26	6.8	6.8	98.2		Aspen
12-Jun-95	26	6.9	6.9	98.2		Aspen
13-Jun-95	26	7.2	7.2	97.8		Coulee Shrubland
14-Jun-95	26	6.9	6.9	97.7		Coulee Shrubland
16-Jun-95	26	7.3	7.3	96.7		Upland grassland
17-Jun-95	26	7.4	7.4	97.8		Douglas fir
18-Jun-95	26	7.2	7.2	97.8		Coulee Shrubland

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location Easting	Local UTM Location Corrected Easting	Local UTM Location Northing	No./Date Fawn(s) Observed	Habitat Description
20-Jun-95	26	7.4	7.4	96.6	2	Coulee grassland
21-Jun-95	26	7.4	7.4	96.5		Coulee grassland
29-Jun-95	26	7.3	7.3	96.5		Upland grassland
Deer No. 28 - 148.566						
2-Jun-92	28	12.4	12.4	98		Coulee Shrubland
3-Jun-92	28	12.4	12.4	98		Coulee Shrubland
10-Jun-92	28	12.1	12.1	100		Cottonwood
6-Jun-93	28	12.0	12.0	100.3	1	Coulee Shrubland
Deer No. 29 - 150.064						
2-Jun-92	29	11.6	11.6	101.6		Douglas Fir
3-Jun-92	29	11.6	11.6	101.6		Cottonwood
6-Jun-93	29	12.8	12.8	100.5		Coulee Shrubland
8-Jun-93	29	12.5	12.5	100.4		Upland grassland
3-Jun-94	29	10.0	10.0	102.1		Coulee Shrubland
23-Jun-94	29	12.0	12.0	100.4		Coulee grassland
14-Jul-94	29	9.8	9.8	100.6	1	Cultivated
Deer No. 35 - 150.073						
2-Jun-92	35	7.7	7.7	96.5		Douglas Fir
4-Jun-92	35	8.0	8.0	97.3		Coulee Shrubland
9-Jun-92	35	8.6	8.6	97.5		Douglas Fir
11-Jun-92	35	8.1	8.1	97.3		Coulee Shrubland
5-Jun-93	35	8.4	8.4	97.5		Coulee grassland
7-Jun-93	35	8.5	8.5	97.5		Upland grassland
9-Jun-93	35	8.4	8.4	97.5		Douglas Fir
10-Jun-93	35	8.1	8.1	97.4		Douglas Fir
14-Jun-93	35	7.7	7.7	97.0	1	Douglas Fir
3-Jun-94	35	8.1	8.1	97.2		Aspen
13-Jun-94	35	7.5	7.5	96.9	1	Upland grassland
11-Jul-94	35	6.1	6.1	96.9		Upland grassland
1-Jun-95	35	8.8	8.8	97.3		Coulee grassland
6-Jun-95	35	8.2	8.2	97.5		Coulee Shrubland
8-Jun-95	35	8.2	8.2	97.3		Douglas Fir

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location Easting	Local UTM Location Corrected Easting	Local UTM Location Northing	No./ Date Fawn(s) Observed	Habitat Description
14-Jun-95	35	8.2	8.2	97.3		Douglas Fir
17-Jun-95	35	7.3	7.3	97.8		Douglas Fir
20-Jun-95	35	7.7	7.7	96.5		Coulee grassland
21-Jun-95	35	7.5	7.5	96.8		Douglas Fir
22-Jun-95	35	8.8	8.8	97.2		Coulee Shrubland
23-Jun-95	35	8.1	8.1	97.6		Coulee Shrubland
27-Jun-95	35	7.7	7.7	97.2		Coulee Shrubland
29-Jun-95	35	8.3	8.3	97.5	1	Coulee Shrubland
Deer No. 38 - 150.083						
2-Jun-92	38	14.3	14.3	90.7		Aspen
4-Jun-92	38	14.3	14.3	90.7		Aspen
8-Jun-92	38	13.6	13.6	90.3		Aspen
11-Jun-92	38	13.8	13.8	91.9		Upland grassland
12-Jun-92	38	13.7	13.7	90.7	2	Coulee grassland
5-Jun-93	38	13.6	13.6	90.5		Coulee Shrubland
7-Jun-93	38	13.6	13.6	90.6		Aspen
9-Jun-93	38	14.0	14.0	90.8		Coulee Shrubland
14-Jun-93	38	14.5	14.5	91.3	2	Upland grassland
10-Jun-94	38	14.2	14.2	91.1		Coulee grassland
17-Jun-94	38	13.8	13.8	90.6		Aspen
30-Jun-94	38	13.8	13.8	90.6		Aspen
19-Jul-94	38	14.9	14.9	90.9	1	Aspen
31-May-95	38	13.9	13.9	90.8		Coulee Shrubland
2-Jun-95	38	13.4	13.4	90.7		Upland grassland
5-Jun-95	38	13.6	13.6	90.6		Aspen
8-Jun-95	38	13.5	13.5	90.6		Coulee Shrubland
12-Jun-95	38	13.4	13.4	90.3		Aspen
19-Jun-95	38	14.0	14.0	91.5		Upland pasture
20-Jun-95	38	13.9	13.9	91.7	1	Upland pasture
21-Jun-95	38	14.3	14.3	91.2		Upland pasture
22-Jun-95	38	14.3	14.3	91.3		Upland pasture
26-Jun-95	38	13.8	13.8	91.6		Upland pasture
Deer No. 39 - 150.263						
10-Jun-94	39	7.8	7.8	99.1		Cottonwood
15-Jun-94	39	5.1	5.1	97.5		Upland grassland
27-Jun-94	39	3.2	3.2	97.8	1	Upland grassland

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location			No./ Date Fawn(s) Observed	Habitat Description
		Easting	Corrected Easting	Northing		
5-Jul-94	39	3.2	3.2	97.1		Aspen
11-Jul-94	39	10.5	10.5	97.2		Cultivated
1-Jun-95	39	5.2	5.2	96.7		Aspen
6-Jun-95	39	4.5	4.5	96.7		Aspen
7-Jun-95	39	4.5	4.5	96.7		Aspen
8-Jun-95	39	3.6	3.6	96.4		Aspen
9-Jun-95	39	3.7	3.7	96.4		Coulee Shrubland
13-Jun-95	39	3.6	3.6	97.1	2	Coulee Shrubland
Deer No. 42 - 150.104						
1-Jun-92	42	14.4	14.4	99.5		Coulee Shrubland
2-Jun-92	42	14.5	14.5	99.4		Coulee Shrubland
11-Jun-92	42	12.5	12.5	109.0		Coulee Shrubland
12-Jun-92	42	12.5	12.5	103.0		Coulee grassland
6-Jun-93	42	87.1	21.1	98.7		Coulee grassland
7-Jun-93	42	86.4	20.4	99.3		Upland grassland
8-Jun-93	42	86.4	20.4	98.5		Upland shrub
11-Jun-93	42	86.7	20.7	98.4		Coulee Shrubland
17-Jun-93	42	86.8	20.8	98.2	1	Coulee Shrubland
3-Jun-94	42	13.4	13.4	101.5		Upland grassland
24-Jun-94	42	14.5	14.5	99.7		Upland grassland
5-Jul-94	42	12.9	12.9	99.8	1	Coulee Shrubland
7-Jul-94	42	12.3	12.3	102.2	1	Douglas Fir
Deer No. 45 - 150.124						
2-Jun-92	45	3.1	3.1	97.1		Aspen
4-Jun-92	45	3.2	3.2	96.0		Aspen
10-Jun-92	45	3.6	3.6	96.5		Upland shrub
Deer No. 46 - 150.156						
2-Jun-92	46	12.0	12.0	100.6		Cottonwood
3-Jun-92	46	12.2	12.2	100.2		Cottonwood
10-Jun-92	46	11.9	11.9	101.6		Coulee grassland
10-Jun-92	46	11.9	11.9	100.9		Coulee Shrubland
12-Jun-92	46	11.9	11.9	100.9		Coulee Shrubland
6-Jun-93	46	12.0	12.0	100.3		Coulee Shrubland
9-Jun-93	46	11.7	11.7	101.6		Aspen

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location			No./ Date Fawn(s) Observed	Habitat Description
		Easting	Corrected Easting	Northing		
11-Jun-93	46	11.7	11.7	101.6		Douglas Fir
17-Jun-93	46	11.7	11.7	101.7	1	Aspen
Deer No. 47 - 150.164						
2-Jun-92	47	8.5	8.5	97.4		Douglas Fir
4-Jun-92	47	7.9	7.9	97.2		Coulee Shrubland
9-Jun-92	47	7.9	7.9	97.0		Douglas Fir
11-Jun-92	47	7.4	7.4	96.6		Douglas Fir
5-Jun-93	47	8.5	8.5	97.3		Upland grassland
7-Jun-93	47	8.2	8.2	97.4		Aspen coulee
9-Jun-93	47	7.9	7.9	97.0		Douglas Fir
10-Jun-93	47	7.9	7.9	97.3		Douglas Fir
14-Jun-93	47	8.2	8.2	97.3		Upland grassland
18-Jun-93	47	8.0	8.0	97.4	1	Coulee Shrubland
3-Jun-94	47	8.2	8.2	97.4		Aspen
14-Jun-94	47	8.1	8.1	97.8		Coulee Shrubland
23-Jun-94	47	9.2	9.2	97.1		Upland grassland
27-Jun-94	47	7.9	7.9	97.4		Upland grassland
30-Jun-94	47	8.1	8.1	97.8		no visual
7-Jul-94	47	8.2	8.2	97.3	3	Upland grassland
14-Jul-94	47	0.8	0.8	97.2		Aspen
1-Jun-95	47	8.0	8.0	97.3		Coulee grassland
6-Jun-95	47	8.2	8.2	97.5		Coulee Shrubland
8-Jun-95	47	8.2	8.2	97.3		Douglas Fir
13-Jun-95	47	8.2	8.2	98.0		Coulee Shrubland
14-Jun-95	47	8.2	8.2	98.3	2	Upland grassland
17-Jun-95	47	8.2	8.2	98.1		Upland grassland
23-Jun-95	47	8.2	8.2	97.5		Upland grassland
27-Jun-95	47	8.1	8.1	98.0		Upland grassland
29-Jun-95	47	8.1	8.1	97.4		Coulee Shrubland
Deer No. 51 - 150.206						
7-Jun-94	51	91.1	25.1	93.1		Cottonwood
14-Jun-94	51	90.3	24.3	93.4		Aspen
21-Jun-94	51	91.1	25.1	93.8	2	Upland grassland
5-Jun-95	51	90.9	24.9	93.7		Coulee Shrubland
6-Jun-95	51	91.1	25.1	93.5		Coulee Shrubland

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location Easting	Corrected Easting	Northing	No./ Date Fawn(s) Observed	Habitat Description
7-Jun-95	51	91.8	25.8	94.4		Upland grassland
12-Jun-95	51	90.9	24.9	93.8		Coulee Shrubland
15-Jun-95	51	90.9	24.9	93.8		Coulee Shrubland
16-Jun-95	51	91.2	25.2	93.7	1	Coulee grassland
21-Jun-95	51	91.2	25.2	93.7		Coulee grassland
22-Jun-95	51	90.8	24.8	93.6		Coulee Shrubland
30-Jun-95	51	90.9	24.9	93.9		Upland grassland
Deer No. 54						
7-Jun-94	54	99.4	33.4	92.2		Cottonwood
21-Jun-94	54	99.5	33.5	92.4		Cottonwood
Deer No. 55 - 150.303						
10-Jun-94	55	85.9	19.9	96.0		Aspen
11-Jul-94	55	16.5	16.5	95.0		Upland grassland
Deer No. 57 - 150.023						
14-Jun-94	57	9.0	9.0	98.2		Upland grassland
Deer No. 59 - 150.295						
10-Jun-94	59	13.8	13.8	92.4		Upland grassland
27-Jun-94	59	15.1	15.1	92.5		Douglas Fir
1-Jun-95	59	15.4	15.4	92.4		Aspen
2-Jun-95	59	15.1	15.1	93.5		Coulee Shrubland
5-Jun-95	59	15.1	15.1	93.5		Coulee Shrubland
7-Jun-95	59	15.1	15.1	93.6		Coulee grassland
13-Jun-95	59	14.9	14.9	92.6		Aspen
15-Jun-95	59	15.3	15.3	93.1		Upland grassland
17-Jun-95	59	15.2	15.2	93.2	1	Coulee Shrubland
19-Jun-95	59	15.1	15.1	93.1		Coulee Shrubland
28-Jun-95	59	14.7	14.7	92.9		Coulee Shrubland
Deer No. 60 - 150.314						
10-Jun-94	60	10.1	10.1	97.3		Upland grassland
27-Jun-94	60	11.2	11.2	97.9		Upland grassland
Deer No. 62 - 150.194						
3-Jun-94	62	14.1	14.1	100.8		Upland grassland
27-Jun-94	62	14.5	14.5	99.7		Coulee Shrubland

Appendix Table 2. Complete relocation file on radio-collared adult female mule deer during the fawning season for four consecutive years at the Oldman Reservoir, 1992 - 1995.

Deer No. and Date Relocated, by Year	Deer No.	Local UTM Location			No./ Date Fawn(s) Observed	Habitat Description
		Easting	Corrected Easting	Northing		
2-Jun-95	62	11.5	11.5	101.8		Aspen
12-Jun-95	62	11.6	11.6	102.0		Coulee Shrubland
14-Jun-95	62	11.5	11.5	101.8		Coulee Shrubland
16-Jun-95	62	11.5	11.5	102.2		Upland grassland
21-Jun-95	62	11.0	11.0	102.2		Cultivated
22-Jun-95	62	11.2	11.2	102.3		Cultivated
23-Jun-95	62	11.6	11.6	102.2		Coulee Shrubland
26-Jun-95	62	10.8	10.8	102.3	1	Cultivated
Deer No. Y4 - 150.184						
1-Jun-95	Y4	15.4	15.4	92.4		Aspen
2-Jun-95	Y4	15.1	15.1	93.5		Coulee Shrubland
7-Jun-95	Y4	15.1	15.1	93.6		Coulee grassland
13-Jun-95	Y4	15.3	15.3	92.5		Aspen
17-Jun-95	Y4	15.1	15.1	93.1		Coulee Shrubland
19-Jun-95	Y4	15.1	15.1	93.1		Coulee Shrubland
20-Jun-95	Y4	15.0	15.0	93.5		Coulee Shrubland
28-Jun-95	Y4	12.8	12.8	93.9		Upland grassland
Deer No. Y8 - 150.036						
7-Jun-93	Y8	16.1	16.1	92.9		Upland grassland
9-Jun-93	Y8	16.2	16.2	92.7		Upland grassland
11-Jun-93	Y8	16.0	16.0	92.7		Upland grassland
18-Jun-93	Y8	16.4	16.4	92.6		Coulee grassland
10-Jun-94	Y8	15.9	15.9	94.1	2	unknown
8-Jul-94	Y8	16.5	16.5	94.7		Upland grassland
1-Jun-95	Y8	16.4	16.4	92.8	2	Upland grassland

Appendix Table 3. Distance between mule deer fawn birth locations during 4 consecutive years of study at the Oldman Reservoir, 1992 to 1995.

		1992 Birth Location		1993 Birth Location			1994 Birth Location				1995 Birth Location				
Deer No.	Radio Freq.	Corr. East	North	Corr. East	North	Dist. from 1992 (km)	Corr. East	North	Dist. from 1992 (km)	Dist. from 1993 (km)	Corr. East	North	Dist. from 1992 (km)	Dist. from 1993 (km)	Dist. from 1994 (km)
6	148.731			29.8	92.8						18.6	83.8		14.37	
7	149.921	06.3	98.2	06.7	97.6	0.72	07.3	98.3	1.00	0.92					
8	149.951			24.0	93.6		24.0	93.4		0.20	24.3	93.7		0.32	0.42
13	150.095			29.4	93.1										
16	150.116										31.3	93.1			
22	150.014						24.5	93.0							
25	150.045	12.0	101.7	11.7	102.5	0.85					11.6	101.8	0.41	0.71	
26	150.055	05.5	97.3	07.4	97.8	1.96	04.9	97.5	0.63	2.52	07.4	96.6	2.00	1.20	2.66
28	148.566			12.0	100.3										
29	150.064														
35	150.073			07.7	97.0		07.5	96.9		0.22	08.3	97.5		0.78	1.00
38	150.083	13.7	90.7	14.5	91.3	1.00	14.9	90.9	1.22	0.57	13.9	91.7		0.72	1.28
39	150.263						03.2	97.8			03.6	97.1			0.81
42	150.104			20.8	98.2		12.3	102.2		9.39					
45	150.124														
46	150.156			11.7	101.7										
47	150.164			08.0	97.4		08.2	97.3		0.22	08.2	98.3		0.92	1.00
Radio collared January 1993															
Y4	150.184										12.8	93.9			

Appendix Table 3. Distance between mule deer fawn birth locations during 4 consecutive years of study at the Oldman Reservoir, 1992 to 1995.

		1992 Birth Location		1993 Birth Location			1994 Birth Location				1995 Birth Location				
Deer No.	Radio Freq.	Corr. East	North	Corr. East	North	Dist. from 1992 (km)	Corr. East	North	Dist. from 1992 (km)	Dist. from 1993 (km)	Corr. East	North	Dist. from 1992 (km)	Dist. from 1993 (km)	Dist. from 1994 (km)
Y8	150.036						15.9	94.1		1.58	16.4	92.8			1.39
Radio collared January-February 1994															
51	150.206						25.1	93.8			25.2	93.7			0.10
54	150.555														
55	150.303														
57	150.023														
59	150.295										15.2	93.2			
60	150.314														
62	150.194										10.8	102.3			
65	150.005														

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